Novel Rod Design featuring 3D shape change with lengthening: A new concept in the management of EOS.

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Introduction

- Current growing rod technologies obtain correction of deformity primarily by distraction.
- Segmental fixation may permit more effective 3D growth modulation therapies in EOS.
- This may be facilitated by percutaneous pedicle screw placement using radiological guidance which is now an accepted technique in adult spine surgery.

Introduction

• Segmental fixation in EOS may be further facilitated and its growth modulating potential enhanced by development of rod designs which change shape with distraction to give a 3D correction of the deformity while maintaining spinal flexibility.

Aim

- The aim of this study is to discuss two growing rod designs which
 - Fit onto a variety of different deformity shapes
 - Retain a physiological range of motion
 - Undergo a 3D change in shape to correct deformity as the rod is distracted by growth and/or other mechanical means

Methods

- Two rod designs were developed and modeled using CAD software:
 - A telescopic rod
 - A hinged rod
- Prototypes were built.
- The hinged device was developed further, mechanically tested and tested in a sheep deformity model.

Results: Design 1

•System of interlocking telescopic curved rods

•Can fit onto a wide variety of different deformities

•Gives good increase in spinal length and 3D correction of deformity with distraction.

•Maintains near physiologic range of motion



Results: Design 2

•System of four sloppy angled hinges linked together and attached to the spine via 5 vertebral body screws.

•The device allows a near physiological defined range of motion.

•It may be adapted for posterior use.

Results: Design 2

•Flexible rod is composed of sloppy hinges orientated at an angle

• Individual hinges are joined together via a variable angle system to make the construct (this angle defines the sagittal contour)

•Flexible rod changes 3D shape after implantation driven by the patients own growth/distraction. QuickTime™ and a decompressor are needed to see this picture.

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Results: Induction of Scoliosis



Conclusions

- Treatment of EOS with growing rods is at an early stage in its evolution
- Dynamic rod designs which give 3D correction of deformity with distraction may be more effective than current methods of growth modulation